REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 4 and 5 have been amended. No new matter is being presented, and approval and entry are respectfully requested.

Claims 4 and 5 are pending and under consideration. Reconsideration is respectfully requested.

EXAMINER'S RESPONSE TO ARGUMENTS:

In the Office Action, at pages 2-4, numbered paragraph 1, the Examiner presented her response to Applicants' arguments.

For clarity, Applicants' responses regarding the Examiner's comments are set forth in the following sections:

1. <u>Page 2, Lines 1-10</u>

In the neutron activation analysis of the prior art, it is only a single gamma-ray that can be identified at a time of detection with a single detector or with a plurality of gamma-ray detectors, and therefore, when a plurality of gamma-rays are emitted concurrently, the information on other gamma-rays except one to be identified will be neglected. In contrast, the method of the present invention as set forth in claim 4 has an inventive feature in that a plurality of gamma-rays which are emitted concurrently can be identified at the same time with a multiple gamma-ray detector assembly comprising a plurality of gamma-ray detectors.

2. <u>Page 2, Lines 10-14</u>

The present invention of claim 4 utilizes a two-dimensional matrix constructed of two axes for energies of a pair of gamma-rays that are concurrently emitted from each radionuclide. As can be seen in Figures 2 and 3, a variety of ways for making a three-dimensional plot from a two-dimensional matrix can be applied in the present invention. The claimed inventions of claims 4 and 5 are not limited to any specific way of making a three-dimensional plot from a two-dimensional matrix.

The construction of a two-dimensional matrix can be specified in detail as follows:

a. Making a field of a two-dimensional matrix by scaling an axis of abscissas to 1,000 channels and an axis of ordinates to 1,000 channels at an allocation of one keV for a channel. The counts on the matrix are all set to zero.

b. Digitizing the energies of a pair of gamma-rays that has been detected at the same time: for example, energies of 121.8. keV and 841.6 keV to 121 channel and 841 channel, respectively.

c. On the two-dimensional matrix, counting by one at the point of intersection by the 121st point on the axis of abscissas and 841st point on the axis of ordinates.

d. Repeating b through c for each detected data, and making a frequency distribution on the two-dimensional matrix.

e. Count may be represented either on the third axis to make a three-dimensional plot as in Figure 2 or by coloration or gradation to make a plot as in Figure 3.

3. Page 2, Line 15 to Page 3, Line 13

As stated above, the present invention of claims 4 and 5 are characterized in utilizing a two-dimensional matrix constructed by two axes for energies of a pair of gamma-rays that are concurrently emitted from each radionuclide. It is important to specify the correlation between a pair of gamma-rays.

Of a pair of gamma-rays that are concurrently emitted, since the time emitted cannot be ordered, the 10 peaks shown in Figure 2 are a superposition of the 5 peaks. This is also represented in Figure 3 which shows symmetric features with respect to an axis of "X-Y".

4. Page 3. Line 14 to Page 4. Line 5

The applicant respectfully submits that Matrix 5 does not convey both real information and spurious information.

In constructing a two-dimensional matrix, the peaks depicted are symmetrical with respect to an axis of "X-Y", for example, between the case where an energy of 121 keV is detected by detector A, and an energy of 841 keV is detected by detector B, and the case where an. energy of 121 keV is detected by detector B, and an energy of 841 keV is detected by detector A. These cases are both real events.

In addition, the applicant respectfully submits that contrary to the Examiner's statement, there is a benefit to comparing the energy of simultaneous gamma emissions measured by different detectors to each other.

For instance, provided there are no interfering energies derived from other radionuclides, detection of a pair of gamma-rays (121.8 keV and 841.6 keV) represents existence of ^{152}Eu nuclide. However, if there are a number of radionuclides, since gamma-rays having close energy levels coexisting in actuality, it will be impossible to identify any

nuclide from only a single gamma-ray. In the case of detection of ^{104}Mo in Cole et al., the foregoing holds true, and this is apparent from the fact that the sample comprising only Mo isotopes is used. The present invention of claims 4 and 5 enables multiple radionuclides to be identified and quantified by taking into account the condition that a pair of gamma-rays having the particular energies (for example, 121.8 keV and 841.6 keV for ^{152}Eu) are concurrently emitted.

Hence, it is respectfully submitted that Applicants have overcome the Examiner's concerns in her comments.

OBJECTIONS TO THE SPECIFICATION:

In the Office Action, at page 5, numbered paragraph 2, the specification was objected to because no units were given for the resolution values.

This specification has been amended to recite that this resolution is generally defined as "E / delta-E", where "E" is the gamma-ray energy and "delta-E" is the fullwidth-at-half-maximum of its gamma-ray peak. Thus, the resolution value is a nondimensional number, and is represented without a unit. To make the foregoing clear, the definition of resolution is added at Page 1, Line 20 of the specification (see above).

Therefore, the outstanding specification objections should be resolved.

Reconsideration and withdrawal of the outstanding objections to the specification are respectfully requested.

OBJECTIONS TO THE CLAIMS:

In the Office Action, at page 5, numbered paragraph 3, claim 4 was objected to. Corrections to claim 4 have been made in accordance with the Examiner's suggestions. That is, between the terminology "concurrently from" and "of the radionuclides", the term "each" has been changed to "any." Therefore, the outstanding objection to claim 4 should be resolved.

Reconsideration and withdrawal of the outstanding objection to claim 4 are respectfully requested.

REJECTION UNDER 35 U.S.C. §112:

In the Office Action, at pages 5-6, numbered paragraph 5, claims 4 and 5 were rejected under 35 U.S.C. §112, second paragraph, for the reasons set forth therein. This rejection is traversed and reconsideration is requested.

Claims 4 and 5 have been amended for clarity. It is respectfully submitted that the amendments to claims 4 and 5 are clearly supported by the entirety of the specification, claims and drawings as originally filed, and that the amended claims 4 and 5 overcome the objections under 35 U.S.C. §112, second paragraph.

REJECTION UNDER 35 U.S.C. §103:

In the Office Action, at pages 7-8, numbered paragraph 8, claims 4 and 5 were rejected under 35 U.S.C. §103(a) as being unpatentable over any one of Cole et al., Schultz et al., Horrocks et al., or Gozani et al., and further in view of Vouropoulos et al. and Shao et al. (USPN 5,999,588). This rejection is traversed and reconsideration is requested.

Claims 4 and 5 have been amended for clarity.

The Examiner appears to consider that the two-dimensional matrix of the present invention corresponds to no more than a conventional three-dimensional plot made by three, less significant, simple parameters. However, the applicants respectfully submit that this is a misunderstanding.

As is clear from the claims and specification, the present invention relates to a method for qualitatively and quantitatively analyzing multiple radionuclides at the same time, and is characterized in utilizing a two-dimensional matrix constructed by two axes for energies of a pair of gamma-rays that are concurrently emitted from each radionuclide.

The two-dimensional matrix of the present invention has an inventive feature of showing the correspondence between the particular radionuclide and the energies of a pair of gamma-rays emitted from the radionuclide. Such a two-dimensional matrix is constructed by the particular, significant parameters: namely, energies of a pair of gamma-rays concurrently emitted from each of the particular radionuclides. When a pair of gamma-rays are concurrently emitted from each radionuclide, simultaneous analysis on multiple radionuclides can be accomplished only when the two-dimensional matrix of the present invention is utilized to identify and quantify each radionuclide from the information on a pair of gamma-rays concurrently emitted from the radionuclide.

On the other hand, none of Cole et al., Schultz et al., Horrocks et al., Gozani et al., or Shao et al. disclose a method for identifying and quantifying radionuclides by utilizing a two-dimensional matrix constructed by two axes for energies of a pair of gamma-rays that are concurrently emitted from each radionuclide.

Even if the cited references disclose conventional, two-dimensional or three-dimensional plots, there is no disclosure or suggestion of the two-dimensional matrix

constructed by energies of a pair of gamma-rays concurrently emitted from each of the particular radionuclides. Therefore, it is respectfully submitted that the claimed inventions are not obvious from the cited references.

With regard to Shao et al., it is true that the description referred to by the Examiner (column 12, lines 54-58) relates to a three-dimensional plot. However, Shao et al. does not relate to a method for qualitatively and quantitatively analyzing multiple radionuclides, and the parameters of the plot have no relationship with the parameters in the present invention. Specifically, Shao at al. relates to a deadtime correction in a nuclear medicine imaging system, and the parameters are randoms fraction R_f, singles rate S, and coincidence' rate C (column 9, lines 58-62 of Shao et al.)

Clearly, in comparison with the present invention, Shao et al. has no relationship to the problem to be solved by the present invention. Thus, those skilled in the art would not have been lead to refer to Shao et al. Even if Shao et al. was referred to, since it discloses a three-dimensional plot made by the parameters which are different from the present invention, it would not have been obvious to those skilled in the art to construct a two-dimensional matrix in accordance with the present invention.

Similarly, amended claims 4 and 5 of the present invention are different from, and not taught or suggested by Cole et al., Schultz et al., Horrocks et al., Gozani et al., or Shao et al.

It is respectfully submitted that Vourpoulos et al. teaches identification of individual substances (see abstract, Vourpoulos), and not simultaneous analysis of two radionuclides to ensure complete separation, as is set forth by the present claimed invention.

Hence, it is respectfully submitted that amended claims 4 and 5 are patentable under 35 U.S.C. §103(a) over any one of Cole et al., Schultz et al., Horrocks et al., or Gozani et al., and further in view of Vouropoulos et al. and Shao et al. (USPN 5,999,588).

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot, and further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted to be in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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By: John C. Garvey Reg 28,667
for David M. Pitcher
Registration No. 25,908

1201 New York Avenue, N.W.
Suite 700
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501